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Ethnicity impact on fetal monitoring during labour

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ABSTRACT

Objective. Our society is becoming increasingly more multi-ethnic. This fact could have an effect on several etiopathologies and outcomes of treatment. Therefore, there might also be an effect on the obstetric field. Cardiotocography is the most common way to assess fetal well-being in labour and some researchers also highlighted a possible variability of the CTG trace considering the ethnicity. The main aim of this study was to analyze whether different ethnicities might cause differences in the analysis of CTG traces and therefore influence clinical conduct.
Patients and Methods. This is a descriptive cross-sectional research comparing CTGs performed during labour. Our sample is constituted by pregnant women at 37-42 weeks in a Maternal-Fetal Medical Center in Northern Italy (A.O.U. Maggiore della Carità, Novara), divided into different groups according to the patient's and her partner's ethnicity.
Results. No statistically significant maternal or neonatal differences were observed between the different groups. Neonatal sex was equally distributed. The Apgar index was in the normal range for all groups at both one minute and five minutes, except for two newborns. There were no statistically significant differences in the fetal weight. Almost all women delivered vaginally. Black group showed 4 minutes more of reduced variability (on average) than other groups. No significant differences occurred in the CTGs parameters between the different ethnic groups of women in labour.
Conclusions. Our results would seem encouraging about the use of CTG with equal expectations for all patients, regardless of ethnicity. This is the reason why our research could have useful implications in clinical choices: the CTG trace remains a valid tool for obstetric decision making for all women of any ethnic group.

INTRODUCTION

The assessment of fetal well-being in labour is usually performed with cardiotocography (CTG) [1]. This test uses a continuous electronic record of the baby's heart rate and its temporal relationship to uterine contractions [2]. Despite the widespread use of this method, some concerns have been raised about its unequivocal applicability, as the criticism due to its high false positive rate [2, 3]. The CTG trace is influenced by different variables such as: gestational risk factors, maternal habitus, and different indications for testing [2, 4, 5]. Some researchers also highlighted a possible variability of the CTG trace considering the ethnicity [6-9]. The increasing multi-ethnicity of our society could independently impact on several etiopathologies and outcomes of treatment: the relationship between ethnic group and fetal monitoring features is important in clinical practice [6, 10].

The analysis of ethnic differences is very interesting, considering that previous studies seems to have more closely analyzed the white population than others [11, 12]. In literature, data about this topic have reported less variable CTG traces in black women's fetuses than in other ethnic groups [6, 7, 9, 13].
In studies published so far, CTGs have been analyzed for periods not including labour and have been limited to black *versus* white group comparisons. In our research, however, we also included other ethnic groups considering both maternal and paternal ethnical origins. The main aim of this study is to determine if ethnicity can influence the characteristics of CTG.

PATIENTS AND METHODS

We conducted a descriptive cross-sectional study to compare CTGs performed during labour. Our sample was constituted by pregnant women from 37 to 42 weeks in a Maternal-Fetal Medical Center in Northern Italy (A.O.U. Maggiore della Carità, Novara).
The study conformed to the Ethical Guidelines of the Helsinki Declaration. It was reviewed and approved by the institutional review board committee of the AOU Maggiore della Carità (Novara) before starting the data collection.
Patients were classified according to their ethnic origin. Ethnicity was categorized as: White (Europe, Middle East, North Africa, Latin America), Black (Africa, Afro America), South Asian (India, Pakistan, Bengal), East Asian (China, Korea, Japan), and Caribbean (Dominican Republic, Ecuador, Cuba).
The inclusion criteria were: singleton pregnancy, live fetus at birth at 37-42 weeks of gestations, diagnosis of active labour, absence of any maternal and fetal morbidity (*i.e*. gestational or pregestational diabetes mellitus; hypertensive disorders). Only pregnant women with the same ethnicity of their partners were included in the study. The exclusion criteria were: fetuses with chromosomal and major congenital anomalies, abnormal umbilical artery Doppler, birthweight < 10^{th} and > 90^{th} percentile (according to the population nomograms), twin pregnancies, preterm pregnancies, women in second stage of labour or using epidural analgesia during labour.

Instrument

Data regarding the pregnancy and newborn variables were collected for each patient, and included: age, gestational age at the time of delivery, parity, BMI, type of delivery, characteristics of the amniotic fluid, onset of pregnancy, medication (taken during pregnancy), hyperpyrexia, intake of alcohol or drugs, smoking, rupture of the amnio-choral membranes, fetal sex and weight, Apgar index at 1 and 5 minutes. CTG analysis was performed in the last 30 minutes of the first stage of labour or 30 minutes before cesarean section [2]. For each patient, the duration of the recording was 30 minutes. The monitoring was done with the same frequency in all cases. It was performed to analyze the variables of fetal heart rate with a medium speed of 1 cm/min. Traces were obtained by external CTG and tocography probe using a Philips CTG Avalon FM20. During the recording of CTGs, patients were free to take either the position they wanted or the one suggested by the obstetrician staff according to the stage of labour. The analyzed CTG variables were: number of contractions; basal fetal heart rate; number of accelerations; number of decelerations; length of high variation episodes; total trace duration time; and number of fetal active movements. To eliminate the intra-operator bias on interpretation, all CTGs were always analyzed by the same experienced midwife who has worked in the delivery room for more than 10 years.

Analysis

Numeric variables have been described with counts and percentages, the continuous ones with mean, standard deviation, median and interquartile range. Groups were evaluated with the Chi-square test or with the Fisher test. The distribution of continuous variables within the groups was verified with the analysis of variance or Student's test. Statistical significance threshold was set at $p \leq 0.05$. All analyzes were carried out with the Stata software.

RESULTS

In the period from the 1^{st} of April to the 30^{th} of June 2019, 138 patients were included in the study: 113 belonged to the White ethnic group, 3 to the East Asian ethnic group, 9 to the South Asian ethnic group, 9 to the Black ethnic group and 4 belonged to the Caribbean ethnic group.
Within the White ethnicity group, the most represented country of origin was Italy (85/113; 75.2%) followed by Morocco (9/113; 8%) and Albania (9/113; 8%), Romania (2/113; 1.8%), Spain (1/113; 0.9%), Latvia (1/113; 0.9%), Algeria (1/113; 0.9%), Moldavia (1/113;

0.9%), Tunisia (1/113; 0.9%), Serbia (1/113; 0.9%), Switzerland (1/113; 0.9%) and Peru (1/113; 0,9%).
Within the East Asian ethnic group, patients came from China (2/3; 66.6%) and Philippines (1/3; 33.3%). In the South Asian ethnic group, Pakistan was the nation with most observed patients (7/9; 77.8%), followed by India (1/9; 11.1%) and Bengal (1/9; 11.1%). In the Black ethnic group, Nigerians (7/9; 77.8%) were the most numerous, followed by Senegalese (1/9; 11.1%) and Ivorian ones (1/9; 11.1%). From the Caribbean group, the most represented nationality was Dominican (2/4; 50%), then Ecuadorian (1/4; 25%) and Cuban (1/4; 25%).
The mean and standard deviation of the demographic characteristics of women by ethnic distribution are shown in **Table 1**. The five groups were homogeneous for age, BMI, tabagism, gestational age; parity was greater in the Black group ($p < 0.05$).
The mean and standard deviation of the delivery and neonatal outcomes by ethnic distribution are shown in **Table 2**. Almost all women delivered vaginally, operative deliveries were reported only for 2 cases in the White group (2/113), and cesarean sections only in White (2/113) and Blake ethnicities (2/9). The birth weight for all the groups was higher than 3000 grams (on average). The five groups were homogeneous in the weight and in the sex of the fetuses (71 females *vs* 67 males, in total). The Apgar index was in the normal range for all groups at both one minute and five minutes and there were only two cases that presented an Apgar score ≤ to 7 at 5 minutes, as defined for neonatal asphyxia [2]. These newborns were in the White group.
Data concerning the parameters of CTG tracing are shown in **Table 3**, the average and the standard deviation of the following variables was represented for each ethic group: baseline in beats per minute, number of accelerations, number of decelerations, minutes of reduced variability (< 5 bpm), minutes of normal variability (> 5 bpm), number of active fetal movements, number of contractions.
No significant differences occurred in the CTGs parameters between the different ethnic groups of women in labour, although the Black group showed an increased time of reduced variability compared to the other groups (4 minutes on average).

Table 1. *Demographic characteristics.*

	White	East Asia	South Asia	Black	Caribbean	P-value
Age	32 ± 5.7	30.5 ± 7.1	26.7 ± 3.2	29.8 ± 5.7	28.2 ± 10.2	0.06
BMI	27.1 ± 4.6	26.9 ± 1.4	28 ± 2.9	29.6 ± 5.2	24.3 ± 4,9	0.3
Tabagism	11/113 (9.8 %)	0	0	1/9 (11.1%)	0	1.0
Gestational age	39.8 ± 8.6	39.4 ± 11.3	39.5 ± 8.7	39.5 ± 8.7	39.4 ± 7.9	0.8
Parity	0.6	0.5	0.9	1.7	1.2	**< 0.05**

Table 2. *Neonatal outcomes.*

	White	East Asia	South Asia	Black	Caribbean	P-value
Vaginal delivery	102/113 (90.2%)	3/3 (100%)	9/9 (100%)	7/9 (77.8%)	4/4 (100%)	0.3
Operative vaginal delivery	9/113 (8%)	0	0	0	0	0.3
Cesarean section	2/113 (1.8%)	0	0	2/9 (22.2%)	0	0.3
Apgar 1'	8.2 ± 1.7	9 ± 0	7.8 ± 1.6	8.6 ± 1.0	8.7 ± 0.5	0.6
Apgar 5'	8.9 ± 1.0	9.2 ± 0.5	8.7 ± 0.5	8.8 ± 0.4	9 ± 0.5	0.8
Birth weight (g)	3343.9 ± 392.6	3230 ± 496.5	3125.6 ± 448.0	3521 ± 320.4	3067.5 ± 222.0	0.1
Neonatal sex	M 54/113 (47.8%) F 59/113 (52.2%)	M 2/3 (66.6%) F 1/3 (33.3%)	M 3/9 (33.3%) F 6/9 (66.7%)	M 5/9 (55.6%) F 4/9 (44.4%)	M 3/4 (75%) F 1/4 (25%)	0.5

Table 3. *CTGs variables.*

CTGs features	White	East Asia	South Asia	Black	Caribbean	P-value
Basal line	134.3 ±10.5	142.5 ± 9.6	136.7 ± 8.3	135.5 ±7.3	132.5 ±12.6	0.5
Accelerations	5.8 ± 4.7	5 ± 5.5	6.3 ±7.1	4 ± 2.8	7.5 ± 6.4	0.7
Decelerations	1.8 ± 2.7	2.2 ± 2.6	1.7 ± 3.2	2.1 ± 2.3	0.5 ± 1	0.9
Riduced variability	11.4 ± 8.6	11.2 ±10.3	11.7 ±11.1	**15.4 ± 8.6**	10 ± 8.2	0.7
Normal variability	18.7 ± 8.7	18.7 ± 10.3	18.3 ± 11.1	14.5 ± 8.6	20 ± 8.2	0.7
Fetal active movements	49.5 ± 17.3	53.7 ± 11.0	57.3 ± 21.4	49.2 ±13.4	46.7 ± 15.2	0.7
Uterine contrations	11.2 ± 4.1	10 ± 2.2	13.3 ± 3.8	9.4 ± 3.6	9.5 ± 1.3	0.2

DISCUSSION

Given the multiculturalism of our society and the current increased presence of different ethnic groups, we wanted to evaluate if CTG was equally reliable as an indicator of fetal wellbeing for all human ethnicities.
Racial differentiation was known as an independent factor for some diseases or medical conditions [4, 11, 12, 14, 20]. Moreover, some research evaluated if there was a genetic predisposition or a different autonomic answer for this correlation, particularly in Black people [3, 7, 15]. This could explain a result of our evaluation, the period of reduced variability in the Black group: it was 4 minutes longer than in the other groups, but without any influence on neonatal outcomes and on the clinical conduct (*i.e.* operative vaginal deliveries or cesarean section). However, since the Black group was also different for parity, as shown in **Table 1**, it was not possible to assess if this factor was a confounder. Few studies have been conducted into ethnicity as a factor that could influence the CTG trace; some of them are not so recent or do not have a large sample cohort [3, 7, 13, 16-18]. Moreover, in literature paternal ethnicity was rarely considered [17], although it is a feature worthy of interest, and this is a strong point of strength of our study.

Clinical implications

We chose to study our cohort during labour because it is a very crucial phase of delivery process, with high risks of over- and under-treatment [2]. To our knowledge, there was no literature focusing on correlations between CTGs, labour, and racial differences.

Recommendations for change

The CTG trace remains an important instrument for clinical decisions for all patients of any ethnicity.

Future research

Future studies should be conducted with a larger sample size and evaluating other aspects of the topic, such as fetal pH. Moreover, studies including newborns suffering from other conditions (*i.e.*, neonatal asphyxia) should be encouraged to permit a global evaluation of other severe outcomes.

Limitations

Limits of our study were: the retrospective assessment; the limited number of patients in each group; the non-routine use of the fetal pH test (performed only in selected cases).

CONCLUSIONS

Our results would seem encouraging about the use of CTG with equal expectations for all patients, regardless of ethnicity. This is the reason why our research could have useful implications in clinical choices: the CTG trace remains a valid tool for obstetric decision making for all women of any ethnic group.

COMPLIANCE WITH ETHICAL STANDARDS

Authors contribution

All the authors contributed equally to this work.

Disclosure of interests

The authors declare that they have no conflict of interests.

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None.

Study registration

Study no. CE 172/17.

Ethical approval

The local Ethical Committee approved the study. The study is conformed to STROBE Guidelines.

Informed consent

At admission, the patients signed a general consent that allows us to use their data for research purposes.

Data sharing

Data are available under reasonable request to the correponding author.

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